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**PROVISIONAL APPLICATION FOR PATENT COVER SHEET**

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

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TITLE OF THE INVENTION (500 characters max)					
Renewably Buoyant, Self-Protective Floating Habitat					
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The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.					
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[Page 1 of 2]

Respectfully submitted,

Date 12/11/03

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**Docket Number** FOU03-0003

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**RENEWABLY BUOYANT, SELF-PROTECTIVE  
FLOATING HABITAT**

**CROSS-REFERENCE TO RELATED APPLICATION**

This application is an original provisional application. It does not claim priority back to any previously filed patent application.

**BACKGROUND OF THE INVENTION**

**1. Field of the Invention.**

The present invention relates to a floating habitat that has a dynamic ability to generate its own buoyancy, through the use of external power or by replicating the biotic activity that occurs on wild floating islands. The present invention includes a hydroponic bedding matrix and an embodiment specifically tailored to provide waterfowl nesting habitat.

**2. Description of the Related Art.**

Naturally occurring floating islands are a relatively unique phenomenon, but they do exist in several places in the world, including Australia, Bangladesh, Fiji, Germany, Hungary, India, Italy, Japan, Mexico, Poland, Turkey, Uganda and the United States. There has been much speculation and some research into how these floating islands form, and the answer appears to be specific to each location. Regardless of how they are formed, once present, floating islands provide a unique habitat for plants and some animal species, and they also play an important role in maintaining the health of the water body in which they are situated.

One of the objects of the present invention is to provide an artificial floating habitat that is similar to a naturally occurring floating island in terms of its aesthetic and functional value. It is a further object of the present invention to solve the problem of maintaining the buoyancy of an artificial floating island over time. Researchers have studied how naturally occurring floating islands maintain their buoyancy and have concluded that gas-producing microorganisms play a pivotal role. *See Clark, 2000, infra; Hogg and Wein, 1988, infra.* The present invention utilizes this research by incorporating microorganisms into the floating habitat structure as an option.

A naturally occurring floating island serves several purposes, not the least of which is the aesthetic value it adds to a body of water. It also serves as a habitat for various plant and animal species, and it helps purify the water by decreasing algae growth and slowing the natural process of eutrophication. In bodies of water such as ponds and lakes, algae growth and the natural process of eutrophication can lead to an increase in land mass and corresponding decrease in water volume, the killing of fish and other organisms, and the diminishment of aesthetic appearance.

Various floating mechanisms have been devised with the aim of mimicking some or all of the qualities of a naturally occurring floating island. Some examples of commercialized products along these lines are the artificial islands manufactured by Bestmann-Green of Germany, a “rafted floating ecology” produced by Ocean Arks International in Vermont, and a so-called “eco-island” made by MMG Civil Engineering Systems in the United Kingdom. Bestmann-Green has three floating island products—a laminar floating element of “girder” construction with a mat for rooting vegetation, a flexible vegetation unit made up of three triangular elements lying next to each other that

are flexibly connected to form a single unit, and a modular system of metal frames with a net stretched within it and a planting mat connected to it. Ocean Arks describes its product as “assemblies of engineered ecologies on floating rafts.” The primary function of their product is to purify wastewater, remove pollutants and digest sludge. The MMG eco-island is a framework of UV-protected PVC tubing with a rot-proof base. Buoyancy is created by watertight tubes that are sealed with specialty caps.

In addition to the products described above, there are a number of patents directed toward floating islands or other floating mechanisms designed to purify water, cultivate plants, dispense fertilizer, or counteract the effect of eutrophication. None of these inventions, however, anticipates the combination of features provided by the present invention.

U.S. Patent No. 5,799,440 (Ishikawa *et al.*, 1998) discloses a floating island comprising: (i) a planter with holes in it to allow the roots of the plants to grow into the water and to supply water to the soil in the planter; and (ii) an oxygen-generating agent container attached to the bottom of the planter. The planter is made of a foamed resin with a reinforcing film of polyurethane elastomer on the surface. The invention also includes: (i) a layer of porous material on the inner surface of the bottom of the planter that has an aerobic microorganism immobilized in it; and (ii) a plant cultivation bag to hold the soil. In the preferred embodiment, the oxygen-generating agent is calcium peroxide, and the soil in the planter is covered with a net or fabric that is permeable to water and air and is not harmful to the plants. In addition to generating oxygen, calcium peroxide also eliminates phosphorus, thereby restricting algae growth.

U.S. Patent No. 4,086,161 (Burton, 1978) sets forth an ecological system and method for counteracting the effects of eutrophication in bodies of water such as marshlands, inland ponds and lakes. The system uses clusters of bark fibers positioned in the upper, relatively oxygen-rich zones of such bodies of water. These bark clusters attract and hold excessive nutrient deposition in the form of colloidal wastes and aquatic algae and also provide a safe habitat for algae predators and feeders.

U.S. Patent No. 6,086,755 (Tepper, 2000) provides a floating hydroponic biofiltration device for use in a body of water containing plant-eating fish. The invention includes a float, a mesh and a matting. The float contains an aperture devoid of soil in which a terrestrial plant is inserted. The mesh is at a substantial depth below the float and serves to enable passage of oxygenated water to the plant roots while excluding large plant-eating fish. The mesh also serves as a substrate surface for the growth of nitrogen-converting bacteria, which convert the ammonia of fish waste to nitrates useful to plants. The matting anchors the plant roots and partially excludes plant-eating fish from a portion of the plant roots. In the preferred embodiment, the mesh and matting are formed of plastic.

U.S. Patent Nos. 5,766,474 (Smith *et al.*, 1998) and 5,528,856 (Smith *et al.*, 1996) set forth a biomass impoundment management system that uses sunlight to purify water. The main purpose of this invention is to control impurities in water impoundments, such as ammonia, nitrogen, phosphorous and heavy metals. It is well known that nitrogen and phosphorous are primary food sources for various undesirable algae species, and ammonia and heavy metals are toxic to humans, fish and other organisms. This invention aims to purify water by allowing rooted bottom dwelling plants to grow and remain

healthy on the bottom of a water impoundment while allowing rootless floating plants to grow and remain healthy above them. The non-rooted, floating plants are contained in a large surface area provided by elongated channels, which are oriented in a North-South direction to take full advantage of the sun. The elongated channels are designed to take advantage of wave activity to increase productivity.

U.S. Patent No. 5,337,516 (Hondulas, 1994) sets forth an apparatus for treating waste water that includes a waste water basin and a number of wetland plants in floating containers. The idea underlying this invention is that the root systems of the wetland plants will treat the waste water. The extent of growth of the root systems is controlled by an adjustable platform associated with each floating container, so that the aerobic and anaerobic zones within the waste water basin are controlled and can be adjusted or varied as required. Similarly, U.S. Patent No. 5,106,504 (Murray, 1992) covers an artificial water impoundment system designed to remove biologically fixable pollutants from urban or industrial waste water using aquatic plants to absorb pollutants.

U.S. Patent No. 4,536,988 (Hogen, 1985) relates to a floating containment barrier grid structure for the containment of floating aquatic plants in a body of water. This invention is designed to facilitate the commercial cultivation and harvesting of aquatic plants. The grid structure consists of elongated flexible sheets that are interconnected at spaced intervals along their longitudinal axes to form a plurality of barrier sections in a web-like arrangement. Through the use of an anchoring means, the barrier grid is tensioned so that certain portions of the structure are submerged beneath the surface of the water by a device that harvests the floating aquatic plants.



U.S. Patent Nos. 4,037,360 (Farnsworth, 1977) and 3,927,491 (Farnsworth, 1975) disclose a raft apparatus for growing plants by means of water culture or hydroponics. The raft floats on a nutrient solution, and buoyancy of the rafts is increased during plant growth by placing a small raft on a larger raft or on auxiliary buoyancy means. U.S. Patent No. 5,261,185 (Kolde *et al.*, 1973) also involves an apparatus floating on a nutrient solution. In this invention, rafts are floated in a water culture tank filled with nutrient solution, plant containers are inserted in vertically oriented channels in the raft, and the plants are cultivated by gradually moving the raft from one end of the water culture tank to another.

U.S. Patent No. 4,487,588 (Lewis, III *et al.*, 1984) addresses a submersible raft for the cultivation of plant life such as endangered sea grasses. The raft is manufactured from standard polyvinyl chloride tubing and fittings.

U.S. Patent No. 6,014,838 (Asher, 2000) discloses a simple floatable unit for decorative vegetation. U.S. Patent No. 5,836,108 (Scheuer, 1998) describes a floating planter box comprising a polyhedral planar base member of a synthetic foam resin less dense than water and an optional anchoring means.

U.S. Patent Nos. 5,312,601 (Patrick, 1994) and 5,143,020 (Patrick, 1992) involve a simple apparatus for dispensing fertilizer in a pond. The invention consists of a flotation structure surrounded by a porous material such as a net sack and an opening in the flotation structure through which fertilizer is dumped. The fertilizer is dissolved by water flowing through the net sack at the bottom of the flotation structure.

## BRIEF SUMMARY OF THE INVENTION

The present invention involves a floating habitat that is designed to be renewably buoyant and self-sustaining. The floating habitat comprises buoyant growth medium and optionally includes one or more inflatable bladders. The growth medium can be made of natural or synthetic material and can include plant growth enhancers. The inflatable bladders can be transparent or opaque and rigid or flexible. Gas-producing microorganisms can be added to the growth medium to provide additional buoyancy.

In the first embodiment, the floating habitat comprises one or more flotation units, a source of compressed air, and a means for connecting the source of compressed air to the flotation unit(s). Each flotation unit comprises an individual supply hose, an inflatable bladder, a relief valve, a diffusing manifold, bottom mesh, top mesh, and buoyant growth medium. The bottom and top mesh can be made of separate pieces of material or the same piece of material, and they can also be designed or modified to be resistant or unattractive to chewing animals. In the preferred embodiment, the mesh is sufficiently pliable, or the holes in the mesh are sufficiently large, to allow stems and roots to grow through it, and the mesh is also sufficiently rigid, or the holes in the mesh are small enough, to contain the buoyant growth medium. In an alternate embodiment, the diffusing manifold is positioned beneath the flotation unit by means of an extension tube. In yet another embodiment, the top and bottom mesh are replaced with top and bottom cover that is impermeable to water.

In another embodiment, the floating habitat is equipped with a self-compensating buoyancy system, which can take one of several forms. One possible embodiment of the self-compensating buoyancy system is a float valve system, in which buoyancy is

regulated by a float valve with a ball float and a sealing face. When buoyancy needs to be increased, the ball float presses against the sealing face of the float valve, preventing air in the inflatable bladder from escaping into the atmosphere. When buoyancy needs to be decreased, the ball float is not in contact with the sealing face of the float valve, and air is allowed to escape from the inflatable bladder. At equilibrium, the ball float is lightly in contact with the sealing face of the float valve. Other embodiments of the self-compensating buoyancy system include a submersible, differential pressure gauge system, a conductivity switch, and an exhaust nozzle.

The floating habitat described above can also be specialized for waterfowl nesting. In this embodiment, the floating habitat includes one or more waterfowl nesting structures and, optionally, a predator control device. Live vegetation is selected based on the nesting preferences of a particular species of waterfowl, and the construction material and screen size of the top and bottom mesh are selected to optimize the nesting habitat. The present invention also includes a method of combining any number of the floating habitats described herein to provide safe habitat for juvenile waterfowl, to encourage colony nesting, or to allow for a variety of waterfowl or shore bird species to enjoy suitable habitat on the same floating habitat system. In an alternative embodiment, one or more waterfowl nesting structures are combined with an impermeable closed bag.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a plan view of a first embodiment of the present invention.

Figure 2 is a cross section view taken at I-I of Figure 1.

Figure 3 is a partial view of a first embodiment of the present invention.

Figure 4 is a partial view of a second embodiment of the present invention.

Figure 5 is a cross section view of an alternative embodiment of the flotation unit of the present invention.

Figure 6 is an elevation view of an alternative embodiment of the compressed air source.

Figure 7 is an elevation view of an alternative embodiment of the compressed air source.

Figure 8 is a plan view of an alternative embodiment of the compressed air source of the present invention.

Figure 9 is a cross section view taken at II-II of Figure 8.

Figure 10 is a partial illustration of the self-compensating system of the present invention.

Figure 11 is a partial illustration of the self-compensating system of the present invention.

Figure 12 is a partial illustration of the self-compensating system of the present invention.

Figure 13 is a plan view of an embodiment of the present invention that is specialized for waterfowl nesting.

Figure 14 is a cross section view taken at section III-III of Figure 13.

## REFERENCE NUMBERS

- 1 Compressed air source
- 2 Flotation units
- 3 Main supply hose
- 4 Distribution valve
- 5 Individual supply hoses
- 6 Inflatable bladder
- 7 Relief valve
- 8 Diffusing manifold
- 9 Bottom mesh/bottom cover
- 10 Top mesh/top cover
- 11 Buoyant growth medium
- 12 Air bubbles
- 13 Portion of air bubbles adhering to internal surfaces within flotation unit 2
- 14 Extension tube
- 15 Aquatic plants/live vegetation
- 16 Wind-powered compressor
- 17 Photoelectric-powered compressor
- 18 Photoelectric cell
- 19 Battery
- 20 Electric air pump
- 21 Controller
- 22 Wave-powered air pump

- 23 Waves
- 24 Elastic air chamber
- 25 Outlet tube
- 26 Outlet check valve
- 27 Inlet tube
- 28 Inlet check valve
- 29 Exhaust tube
- 30 Float valve
- 31 Ball float
- 32 Sealing face
- 33 Nesting unit

#### **DETAILED DESCRIPTION OF INVENTION**

The floating habitat of the present invention is designed to be renewably buoyant during its useful life, and it is also designed to be self-sustaining. The floating habitat is self-sustaining because it can withstand temperature extremes and also because its design minimizes the risk of damage by animals. In the preferred embodiment, buoyancy is maintained through the use of buoyant growth medium, inflatable bladders, and a self-compensating buoyancy system. Buoyancy can also be enhanced through the addition of gas-producing microorganisms. The floating habitat of the present invention can also be specialized to provide waterfowl nesting habitat.

The floating habitat of the present invention is equipped with components that supply pressurized air to the submerged portions of the structure in order to increase the

overall buoyancy of the structure. There are several alternative configurations for the air supply system. The first embodiment of the self-pressurized floating habitat system is shown in plan view in Figure 1. A compressed air source 1 is shown mounted on top of flotation units 2. Although the drawing depicts the use of two flotation units 2, any number may be used, depending on the selected size of each flotation unit 2 and the required buoyancy and overall size of the floating habitat. Compressed air is produced by the compressed air source 1, pumped through the main supply hose 3 to the distribution valve 4, and then to the individual supply hoses 5.

Figure 2 is a cross section view taken at section I-I of Figure 1, and it shows the compressed air source 1, the flotation units 2, the main supply hose 3, the distribution valve 4, and an individual supply hose 5. Figure 3 is a partial view of Figure 2. It depicts one flotation unit 2 that is enlarged for magnification purposes. In Figure 3, the major components comprising the flotation unit 2 are the individual supply hose 5, the inflatable bladder 6, the relief valve 7, the diffusing manifold 8, the bottom mesh 9, the top mesh 10, and buoyant growth medium 11. Compressed air from an individual supply hose 5 enters the inflatable bladder 6. The inflatable bladder 6 expands, and its internal air pressure increases until the pressure exceeds the opening pressure of the relief valve 7. When the relief valve 7 opens, excess air exits the inflatable bladder 6, passes through the relief valve 7, and is dispersed in the form of small air bubbles 12 through the diffusing manifold 8. A portion 13 of the air bubbles 12 adheres to either the bottom mesh 9, the top mesh 10, or the buoyant growth medium 11, thereby adding buoyancy to the structure. A portion of the bubbles 12 dissolves into the water that fills the void space between the nodules of growth medium 11, thereby increasing the dissolved air

concentration of such water. A portion of the bubbles 12 is released through the openings of the bottom mesh 9 and top mesh 10 into the water surrounding the flotation unit 2, thereby increasing the dissolved air concentration in the water surrounding the flotation unit 2. The remainder of the bubbles 12 is released through the top mesh 10 into the atmosphere.

The purpose of the distribution valve 4 is to supply an equal portion of the compressed air to each flotation unit 2. This capability is particularly desirable in the event that one or more inflatable bladders 6 becomes punctured because it will allow the other bladders to continue to receive an adequate inflation supply.

The flotation units 2 may optionally be divided into multiple internal compartments with divider panels. The purpose of providing multiple internal compartments is to limit the loss of buoyant growth medium to one compartment in the event that the bottom mesh 9 or top mesh 10 is locally ruptured.

In Figure 2, the flotation unit 2 is shown as a cylindrical shape. The flotation units may be alternately constructed with different shapes, such as oval or rectangular, in order to best suit certain applications for the structure. For any shape of configuration, the bottom mesh 9 and top mesh 10 may be comprised of separate materials, or, alternately, a single piece of material may be rolled so as to serve the function of both the bottom mesh 9 and top mesh 10. One purpose of the bottom mesh 9 and top mesh 10 is to contain the buoyant growth medium 11 while allowing the stems and roots of growing plants (not shown) to extend through the flotation unit into the surrounding water and atmosphere. One example of a suitable material for the bottom mesh 9 and top mesh 10 is polypropylene netting material with ¼-inch mesh opening size. The bottom mesh 9 and



top mesh 10 may optionally be designed or modified to be resistant or unattractive to chewing animals, for example, by adding sand to the resin during the manufacturing process.

The buoyant growth medium 11 may be comprised of either natural material (*e.g.*, wood chips) or synthetic material (*e.g.*, shredded closed-cell polymer foam) that is compatible with the selected vegetation. Additional examples of natural materials that could be used for buoyant growth medium are: cork; balsa wood; pine wood; oak wood; and volcanic rock with naturally sealed air pockets. Additional examples of synthetic materials that could be used for buoyant growth medium are: perlite; polystyrene beads; polystyrene foam; vermiculite; pelite; hollow plastic balls (10 mm); solid polypropylene balls; polyethylene foam, closed cell; vinyl acetate foam, closed cell; polyurethane foam, closed cell; polyimide foam, closed cell; ionomer foam, closed cell; silicone foam, closed cell; PVC foam, closed cell; silicone sponge rubber, closed cell; neoprene sponge rubber, closed cell; natural gum sponge rubber, closed cell; and ECH sponge rubber, closed cell. The growth medium may optionally contain plant growth enhancers. Plant enhancers can include nutrients such as nitrogen, phosphorus, and potassium; pH modifiers; mineral supplements; and mycorrhizha or other symbiotic soil-dwelling organisms.

The inflatable bladders 6 are constructed from a material that is airtight, durable and flexible over the expected range of environmental conditions. Examples of potentially suitable materials include polyvinyl chloride film, polyethylene film or pipe, polypropylene film, polyester film (such as MYLAR ), butyl rubber, neoprene rubber, nitrile rubber, EPDM rubber, and silicone rubber. The material may optionally be transparent in order to discourage chewing damage by inquisitive animals such as

muskrats and mink. The inflatable bladders can be used optionally to decrease the buoyancy of the structure by filling them with water. The water can be subsequently removed, if desired, by using the compressed air system.

A second embodiment of a flotation unit 2 is shown in cross section in Figure 4. In this embodiment, an extension tube 14 is used to position the diffusing manifold 8 beneath the flotation unit 2. Excess air is released through the diffusing manifold 8 into the water body in which the structure is floating. The released air bubbles 12 rise through the water body, where a first portion of the bubbles 12 dissolves into the water, a second portion adheres to the roots of aquatic plants 15 that extend through the bottom mesh 9, and the remainder of the bubbles is dispersed as described for Figure 3. An advantage of this “extended manifold” embodiment is that it provides a means for increasing the dissolved air concentration in the water body, especially in the vicinity of the structure.

A third embodiment of a flotation unit 2 is shown in cross section in Figure 5. In this embodiment, bottom cover 9 and top cover 10 are made of impermeable materials so that they cannot be penetrated by plants, air bubbles, or water. Air enters the flotation unit 2 through an individual supply hose 5 and is released through a diffusing manifold 8, causing the internal pressure of the flotation unit 2 to increase. When the pressure increases to the opening pressure of the relief valve 7, excess air is released through the relief valve 7 to the water body in the form of air bubbles 12. This embodiment may be advantageous for applications where plant growth on the structure is not desired.

Three alternative embodiments of the compressed air source 1 are shown in Figures 6, 7, 8 and 9. The first preferred embodiment of the compressed air source 1 shown in Figure 6 is a wind-powered compressor 16. A second preferred embodiment of

the compressed air source 1 is the photoelectric-compressor system 17 shown in schematic form in Figure 7. Referring to Figure 7, sunlight is converted to electrical current via a photoelectric cell 18. The electrical current is used to charge a battery 19, which is initially disconnected from the air pump 20. When the battery obtains a sufficient charge, as measured by the controller 21, the battery 19 is electrically connected to the air pump 20 by the controller 21, and the air pump 20 then supplies compressed air to the structure through a main supply hose 3 as described previously. When the electrical charge of the battery 19 falls below a preset level, as measured by the controller 21, the battery 19 is disconnected from the air pump 20 until the battery 19 has sufficiently recharged, at which time the pump cycle is repeated.

A third alternative embodiment of the compressed air source is shown in Figures 8 and 9. Figure 8 is a plan view of the present invention with a wave-powered air pump 22. Also shown are two flotation units 2. Figure 9 is a cross section view taken at section II-II of Figure 8. A wave-powered air pump 22 is powered by waves 23 on the surface of the water body that are produced by wind or other action. The wave-powered air pump 22 is comprised of an elastic air chamber 24, an outlet tube 25, an outlet check valve 26, an inlet tube 27, and an inlet check valve 28. Waves 23 on the water surface cause the elastic air chamber 24 to alternately contract and expand, as shown by the dashed lines in Figure 9. When the crest of a wave 23 pushes against the elastic air chamber 24, the elastic air chamber 24 contracts, and air is forced out of the elastic air chamber 24 through the outlet tube 25 and the outlet check valve 26 into the inflatable bladder 6. When the trough of a wave 23 contacts the elastic air chamber 24, the air chamber 24 expands, and air is sucked into the elastic air chamber 24 through the inlet

tube 27 and the inlet check valve 28. The contraction-expansion cycle is repeated for each new wave 23, thereby forcing a pulse of air into the inflatable bladder 6 at each wave cycle. The purpose of the inlet check valve 28 and outlet check valve 26 is to permit air to flow through the wave-powered air pump 22 only in the direction shown by the arrows.

By sparging air bubbles under, around and through the floating habitat as described above, ice damage to the present invention is minimized. The presence of air bubbles under and around the floating habitat leads to thinner ice build-up around the habitat, and accordingly proportionately less ice damage to the present invention. In addition, plant growth is enhanced because the open water season around the floating habitat is extended by virtue of the reduction in ice mass.

The floating habitat structure can optionally be fitted with a self-compensating inflation device, or buoyancy system, that maintains the structure at a constant flotation level regardless of changes in the weight of objects placed on the structure. One embodiment of the self-compensating buoyancy system is shown in Figures 10, 11, and 12. In Figures 10, 11 and 12, the flotation units 2 are shown as being approximately oval in cross section, which is an alternative shape option for the flotation unit 2. Also in this configuration, separate pieces of material are used for the bottom mesh 9 and the top mesh 10, as shown in Figure 10. The structure shown is comprised of a single flotation unit 2.

In Figure 10, the structure has just been installed in a water body. A wind-powered compressor 16 is supplying compressed air through an individual supply hose 5 to an inflatable bladder 6. Air exits the inflatable bladder 6 via an exhaust tube 29,

through the float valve 30, and is vented to the atmosphere around the ball float 31.

Because the ball float 31 is in the lower, or non-floating, position, it does not seal against the sealing face 32 of the float valve 30, and air passes around the ball float 31 with no restriction in the exhaust end of the air pathway. Because excess air is vented to the atmosphere with no restriction in the exhaust end of the air pathway, there is no pressure buildup in the inflatable bladder 6, and, therefore, the bladder 6 is in an unexpanded condition.

In Figure 11, the structure is shown after additional weight has been placed on it. In this example, the additional weight is shown as a growing aquatic plant 15. The weight of the plant 15 causes the structure to sink deeper into the water until the ball float 31 of the float valve 30 presses against the sealing face 32 of the float valve 30. When the ball float 31 seals against the sealing face 32, exhaust air is prevented from escaping into the atmosphere, and pressure rises in the inflatable bladder 6 as additional air enters through the individual supply hose 5. The increase in air pressure causes the inflatable bladder 6 to expand, as shown in Figure 11. The expansion of the inflatable bladder 6 exerts a positive buoyant force on the structure.

In Figure 12, the expansion of the inflatable bladder 6 has caused the structure to begin to rise in the water body. When the structure rises so that the ball float 31 is at the waterline, the air seal between the ball float 31 and the sealing face 32 is lost, and air begins to exit the inflatable bladder 6, which causes the inflatable bladder to contract and provide less buoyant force to the structure. An equilibrium level is established, as shown in Figure 12, wherein the ball float 31 is lightly in contact with the sealing face 32, which causes the structure to achieve a steady-state level of flotation.

There are several alternative embodiments to the float valve system shown in Figures 10 through 12. For structures comprising a battery, such as the one shown in Figure 7, a solid state pressure sensor can be mounted on the lower side of the structure. The sensor can be configured so as to read the differential pressure between the submerged depth and atmospheric pressure. When the structure settles deeper into the water, the measured differential pressure will increase. The sensor circuit can be designed to give an “on” signal, for example, when the differential pressure exceeds a preset limit. The circuit can be configured so as to close the exhaust valve when the structure settles too deeply into the water, thereby causing the structure to inflate and rise. Conversely, when the structure floats too high in the water, the circuit can cause the exhaust valve to open, which will cause the structure to deflate and undergo a decrease in buoyancy. This embodiment is referred to as the “submersible, differential pressure gauge system.”

Another option for structures comprising a battery, such as that shown in Figure 7, is a conductivity sensor that can be installed near the desired water level of the structure. If the structure settles too deeply into the water, the conductivity sensor will become submerged and give an “on” signal. This signal can be used to control the operation of the exhaust valve, as described above. This embodiment is referred to as the “conductivity switch.”

For either electric or non-electric embodiments of the structure, the diffusing manifold 8 shown in Figure 4 can be replaced by a restriction nozzle with a discharge point set near the desired waterline of the structure. The dimensions of the nozzle can be configured so that there is insignificant pressure drop through the nozzle when

discharging to the atmosphere, but significant pressure drop when bubbling out into the water body. The operation of this embodiment would be similar to that described for the float valve system, except that there would be no mechanical seals required. This embodiment is referred to as the “exhaust nozzle.”

As a buoyancy enhancement, gas-producing microorganisms can be added to the floating habitat. The floating habitat can be inoculated with these microorganisms by taking a sample of bacteria-rich soil and introducing it into the growth media. The soil is necessary to achieve inoculation but is not necessary to sustain the bacteria, which can be fed with a high-carbon substrate food source, such as molasses or sugar beet extract. The bacteria will survive the seasonal temperature fluctuations and will produce gases that are trapped in the floating habitat for some time until they escape through the surrounding mesh.

The floating habitat of the present invention can be specialized to provide a nesting structure for wild ducks and other waterfowl. Waterfowl nesting structures are beneficial for sustaining and increasing the production of wild waterfowl where natural nesting sites have been reduced by agriculture, drought, predation, or other causes.

Figure 13 is a plan view of a floating habitat structure that has been specialized for waterfowl nesting. Figure 14 is a cross section view taken at section III-III of Figure 13. The specialized waterfowl nesting structure shown in Figures 13 and 14 incorporates the flotation units 2, optional compressed air source 1, and additional components described below.

The nesting unit 33 is configured to be attractive to the particular species of waterfowl that is being encouraged to nest. One or more nesting units can be provided on

any one floating habitat structure, either for the same or different species. In one preferred embodiment, commercially available HEN HOUSES may be installed on the structures to encourage nesting of, for example, mallard ducks. HEN HOUSES are wire-reinforced straw-filled tubes favored by mallard ducks. Another example of a nesting habitat is a gravel pad favored by plovers. Synthetic or natural grass plots are other examples of nesting habitat favored by other species of waterfowl. Where desired, the nest can be protected from swimming predators by raising the nesting unit 33 and/or installing a predator exclusion disk (not shown) or other predator control device.

Optional live vegetation 15 is selected based on the geographical location of the structure and the nesting preference of the species of waterfowl that is being encouraged to nest on the structure. For example, to attract mallards in northern states, bulrushes and cattails may be the preferred vegetation. At some locations, it may be preferable to omit live vegetation in order to prevent the structure from becoming rooted to the bottom of a shallow or dried-up pond. At other locations, it may be desirable to select the bottom mesh 9 so that plants can grow in the flotation units 2 but their roots cannot penetrate the lower side of the flotation unit 2.

In this embodiment, a compressed air source 1 is located on the structure so as to balance the structure properly, depending on the type of nesting unit 33 that is installed. The construction material and screen size of the top mesh 10 are selected to be attractive to the nesting waterfowl, to be safe for juvenile waterfowl, to provide a substrate for new vegetation growth, and to allow penetration of vegetation stems (when live vegetation is optionally planted within the flotation unit 2). An example of a potentially suitable material for the top mesh 10 is polymer-reinforced jute geotextile matting.



Optionally, two or more of the structures may be joined together so as to provide relatively sheltered water pockets between the individual structures. These sheltered pockets may provide a relatively safe habitat for juvenile waterfowl, and the increased area provided by multiple connected structures may encourage colony nesting of some desirable species or alternatively allow for a variety of waterfowl or shore bird species to enjoy suitable habitat on the same floating habitat system.

There are numerous advantages to the waterfowl habitat design of the present invention. First, the nesting structures can be located in relatively deep water far from shoreline, making them inaccessible to predators such as skunks and red fox.. In addition, the structures may provide more nesting sites than could be provided by traditional post-mounted nesting stations, which require relatively shallow water locations. Second, the nest box portions of the structures can be adapted to match the nesting preference of a particular species of waterfowl. Third, the live vegetation on the structures can be selected to match the nesting preference of a particular species of waterfowl. Fourth, the structures are buoyant and will provide effective nesting habitat during periods of fluctuations of water level. Fifth, the floating habitat can optionally be equipped with a self-compensating buoyancy controller that allows the structure to automatically adapt to variations in weight. Lastly, the floating habitat structures are less expensive than the cost of installing a normal island in a pond and can be moved to new locations as desired.

Another embodiment of the present invention, not illustrated, is a closed bag system in which buoyant growth medium (or buoyant medium if plant growth is not an issue) is contained in a water-permeable or water-impermeable bag, and a waterfowl

nesting structure is added to the floating habitat. The closed bag embodiments can include, optionally, any of the buoyancy mechanisms described above. If a water-impermeable bag were used, then the floating habitat could also include artificial turf or plants to achieve a visual effect similar to a floating habitat with naturally growing vegetation.

Another optional feature for any of the embodiments described above is an anchor tether with swivel capability that provides flexibility so as not to impair the optimal buoyancy of the floating habitat.

Although several embodiments of the present invention have been shown and described, it will be apparent to those skilled in the art that many changes and modifications may be made without departing from the invention in its broader aspects. The appended claims are therefore intended to cover all such changes and modifications as fall within the true spirit and scope of the invention.

## REFERENCES

Mark W. Clark, "Biophysical Characterization of Floating Wetlands (Flotant) and Vegetative Succession of a Warm-Temperate Aquatic Ecosystem," Univ. of Florida Graduate School Dissertation (2000).

Edward H. Hogg and Ross W. Wein, "*Typha* Mat Buoyancy," Ecology, Vol. 69, No. 4 (Aug. 1988).

## DEFINITIONS

The term "ECH" means epichlorohydrin.

The term "EDPM" means ethylene-propylene-diene-methylene.

The term “PVC” means polyvinyl chloride.

The term “waterfowl” means a bird that frequents water and is not intended to be limited to swimming game birds.

## CLAIMS

We claim:

1. A floating habitat comprising buoyant growth medium and gas-producing microorganisms.
2. A floating habitat comprising buoyant growth medium and one or more inflatable bladders.
3. The floating habitat of claim 2, wherein the inflatable bladders are transparent.
4. The floating habitat of claim 2, wherein the inflatable bladders are opaque.
5. The floating habitat of claim 2, wherein the inflatable bladders are rigid.
6. The floating habitat of claim 2, wherein the inflatable bladders are flexible.
7. A floating habitat comprising one or more flotation units, a source of compressed air, and a means for connecting the source of compressed air to the flotation unit(s).
8. The floating habitat of claim 7, wherein each flotation unit comprises an individual supply hose, an inflatable bladder, a relief valve, a diffusing manifold, bottom mesh, top mesh, and buoyant growth medium.
9. The floating habitat of claim 8, wherein the bottom mesh and the top mesh are made of separate pieces of material.
10. The floating habitat of claim 8, wherein the bottom mesh and the top mesh are made of a single piece of material.

11. The floating habitat of claim 8, wherein the bottom and top mesh are designed or modified to be resistant or unattractive to chewing animals.
12. The floating habitat of claim 8, wherein the bottom mesh is sufficiently pliable to allow plant roots to grow through it.
13. The floating habitat of claim 8, wherein the holes in the bottom mesh are sufficiently large to allow plant roots to grow through the bottom mesh.
14. The floating habitat of claim 8, wherein the top mesh is sufficiently pliable to allow plant stems to grow through it.
15. The floating habitat of claim 8, wherein the holes in the top mesh are sufficiently large to allow plant stems to grow through the top mesh.
16. The floating habitat of claim 8, wherein the top and bottom mesh are sufficiently rigid to contain the buoyant growth medium.
17. The floating habitat of claim 8, wherein the holes in the top and bottom mesh are small enough to contain the buoyant growth medium.
18. The floating habitat of claim 8, wherein the diffusing manifold is positioned beneath the flotation unit by means of an extension tube.
19. The floating habitat of claim 7, wherein each flotation unit comprises an individual supply hose, an inflatable bladder, a relief valve, a diffusing manifold, bottom cover, top cover, and buoyant growth medium, wherein the bottom cover and the top cover are made of impermeable materials.
20. The floating habitat of claim 7, wherein the source of compressed air is a wind-powered compressor.

21. The floating habitat of claim 7, wherein the source of compressed air is a photoelectric-compressor system.

22. The floating habitat of claim 21, wherein the photoelectric-compressor system comprises a photoelectric cell, a battery and an air pump.

23. The floating habitat of claim 7, wherein the source of compressed air is a wave-powered air pump.

24. The floating habitat of claim 23, wherein the wave-powered air pump comprises an elastic air chamber, an outlet tube, an outlet check valve, an inlet tube, and an inlet check valve.

25. The floating habitat of claim 7, wherein the flotation unit comprises one or more internal dividers.

26. A floating habitat comprising buoyant growth medium and a self-compensating buoyancy system.

27. The floating habitat of claim 26, wherein the self-compensating buoyancy system comprises a submersible, differential pressure gauge system.

28. The floating habitat of claim 26, wherein the self-compensating buoyancy system comprises a conductivity switch.

29. The floating habitat of claim 26, wherein the self-compensating buoyancy system comprises an exhaust nozzle.

30. A floating habitat comprising a self-compensating inflation device, wherein the self-compensating inflation device comprises a source of compressed air, one or more inflatable bladders, and a means of connecting the source of compressed air to the inflatable bladder(s).

31. The floating habitat of claim 30, further comprising, in connection with each inflatable bladder, a ball float and a float valve with a sealing face.
32. The floating habitat of claim 31, wherein the ball float seals against the sealing face of the float valve when the buoyancy of the inflatable bladder needs to be increased.
33. The floating habitat of claim 31, wherein the ball float is not in contact with the sealing face of the float valve when the buoyancy of the inflatable bladder needs to be decreased.
34. A floating habitat comprising buoyant growth medium and one or more waterfowl nesting structures.
35. The floating habitat of claim 34, wherein the buoyant growth medium is contained in a water-permeable bag.
36. A floating habitat comprising buoyant medium contained in a water-impermeable bag and one or more waterfowl nesting structures.
37. The floating habitat of claim 36, further comprising artificial vegetation.
38. The floating habitat of claims 1, 2, 7, 26 or 30, further comprising a waterfowl nesting structure.
39. The floating habitat of claims 1, 2, 7, 26, 30, 34 or 36, wherein the waterfowl nesting structure is designed to attract a particular species of waterfowl.
40. The floating habitat of claims 1, 2, 7, 26, 30, 34 or 36, further comprising a predator control device.

41. The floating habitat of claims 1, 2, 7, 26, 30 or 34, further comprising live vegetation that is selected based on the nesting preferences of a particular species of waterfowl.

42. The floating habitat of claim 8, further comprising a waterfowl nesting structure, wherein the construction material and screen size of the bottom mesh allows plants to grow in the flotation unit but does not allow plant roots to penetrate the lower side of the flotation unit.

43. The floating habitat of claim 8, further comprising a waterfowl nesting structure, wherein the construction material and screen size of the top mesh are selected to be attractive to a particular species of nesting waterfowl, to be safe for juvenile waterfowl, to provide a substrate for new vegetation growth, and, when live vegetation is optionally planted within the flotation unit, to allow penetration of vegetation stems.

44. A method of combining one or more of the floating habitats of claims 1, 2, 7, 26, 30, 34 or 36 to provide safe habitat for juvenile waterfowl.

45. A method of combining one or more of the floating habitats of claims 1, 2, 7, 26, 30, 34 or 36 to encourage colony nesting.

46. A method of combining one or more of the floating habitats of claims 1, 2, 7, 26, 30, 34 or 36 to allow for a variety of waterfowl or shore bird species to enjoy suitable habitat on the same floating habitat system.

47. A floating habitat comprising buoyant growth medium and an anchor tether with swivel capability that provides flexibility so as not to impair the optimal buoyancy of the floating habitat.



48. The floating habitat of claims 1, 2, 7, 26, 30, 34 or 36, further comprising an anchor tether with swivel capability that provides flexibility so as not to impair the optimal buoyancy of the floating habitat.

49. A floating habitat comprising buoyant growth medium and a source of compressed air, wherein the source of compressed air creates air bubbles that are sparged under the floating habitat.

50. A floating habitat comprising buoyant growth medium and a source of compressed air, wherein the source of compressed air creates bubbles that are sparged around the floating habitat.

51. A floating habitat comprising buoyant growth medium and a source of compressed air, wherein the source of compressed air creates bubbles that are sparged through the floating habitat.

52. A method of using the source of compressed air of claim 49, 50 or 51 to reduce ice damage to the floating habitat and to increase the open water season around the floating habitat.

53. The floating habitat of claims 1, 2, 8, 19, 26, 34, 47, 49, 50 or 51, wherein the buoyant growth medium comprises natural material.

54. The floating habitat of claims 1, 2, 8, 19, 26, 34, 47, 49, 50 or 51, wherein the buoyant growth medium comprises synthetic material.

55. The floating habitat of claims 1, 2, 8, 19, 26, 34, 47, 49, 50 or 51, wherein the buoyant growth medium further comprises one or more plant growth enhancer(s).

56. A method of decreasing the buoyancy of the floating habitat of claims 2, 8, 19 or 30 by filling one or more inflatable bladders with water.

## ABSTRACT OF THE DISCLOSURE

A floating habitat designed to be renewably buoyant and self-sustaining and optionally specialized for waterfowl nesting. The first embodiment comprises one or more flotation units, a source of compressed air, and a means for connecting the source of compressed air to the flotation units. Each flotation unit comprises an individual supply hose, an inflatable bladder, a relief valve, a diffusing manifold, bottom mesh, top mesh, and buoyant growth medium. An alternative embodiment comprises a self-compensating buoyancy system. In the waterfowl nesting embodiment, the floating habitat includes one or more waterfowl nesting structures and construction material selected to optimize the nesting habitat. The floating habitats can be combined to provide safe habitat for juvenile waterfowl, encourage colony nesting, or allow a variety of waterfowl or shore bird species to enjoy suitable habitat on the same floating habitat.

Fig. 1

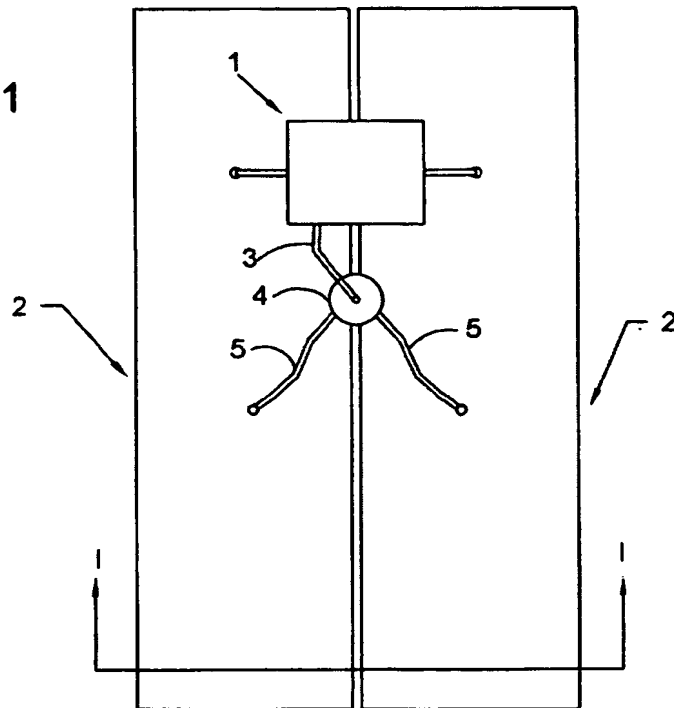


Fig. 2

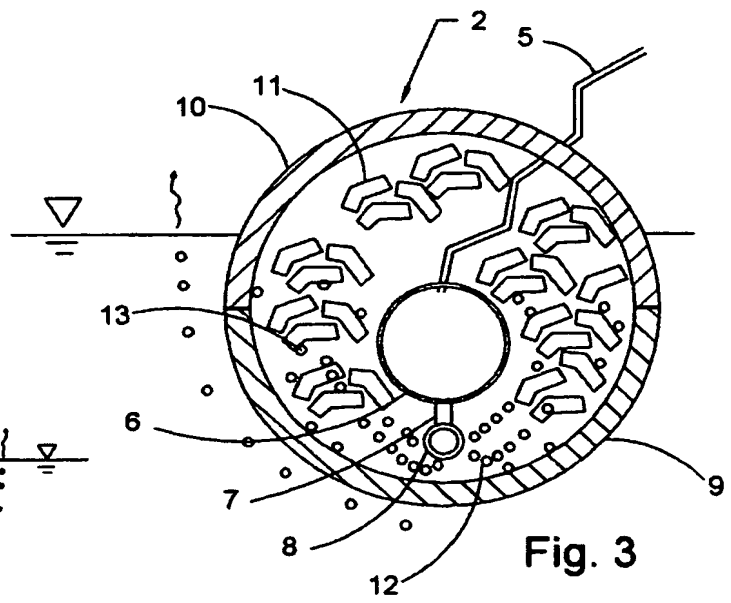
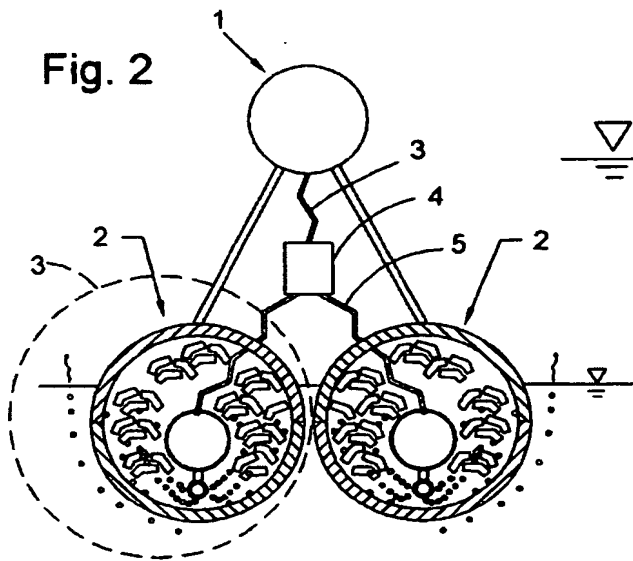


Fig. 3

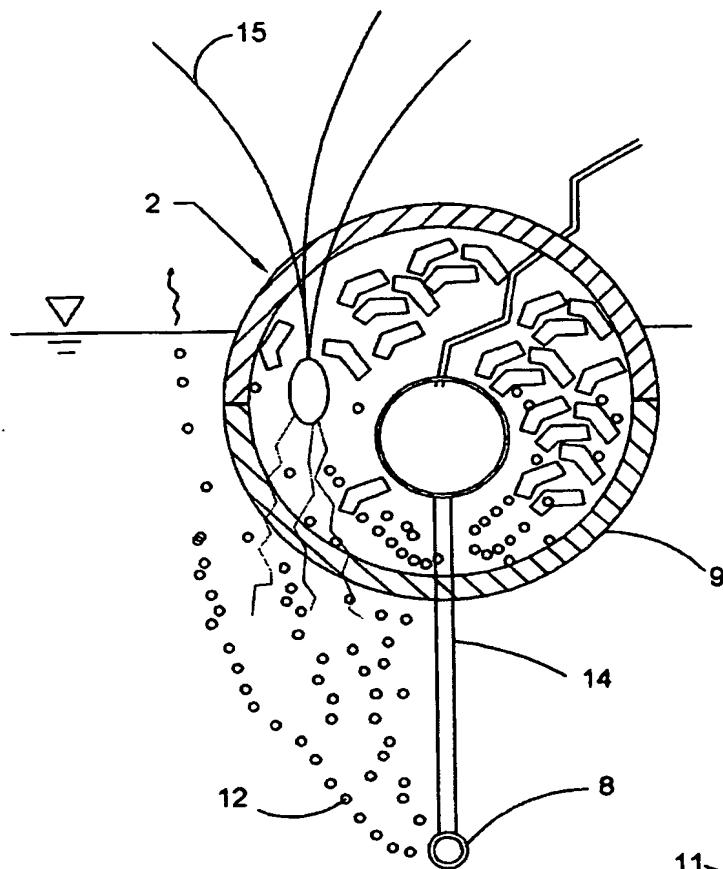


Fig. 4

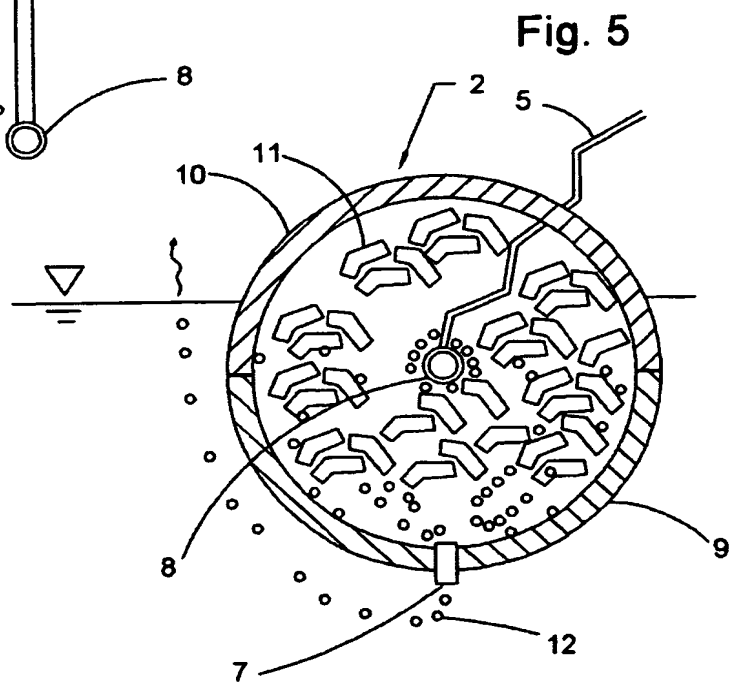


Fig. 5

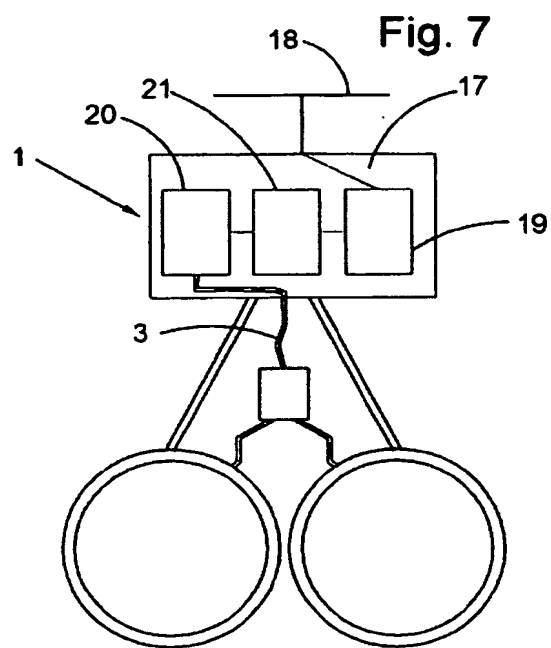
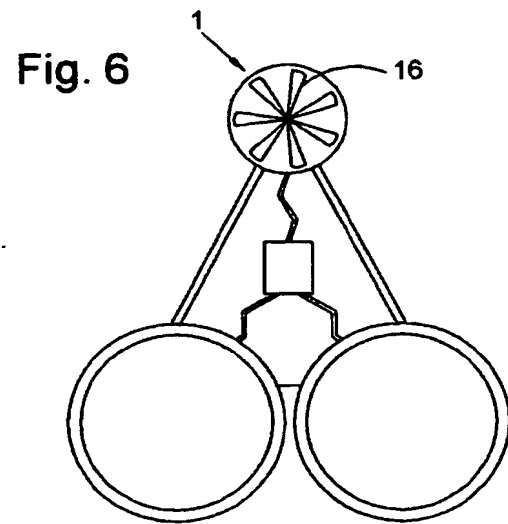


Fig. 8

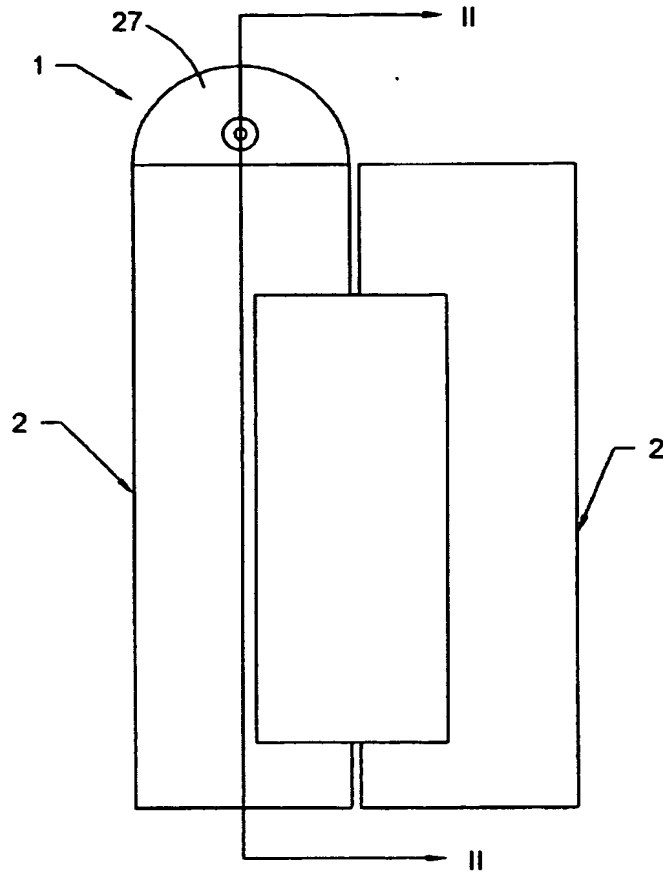


Fig. 9

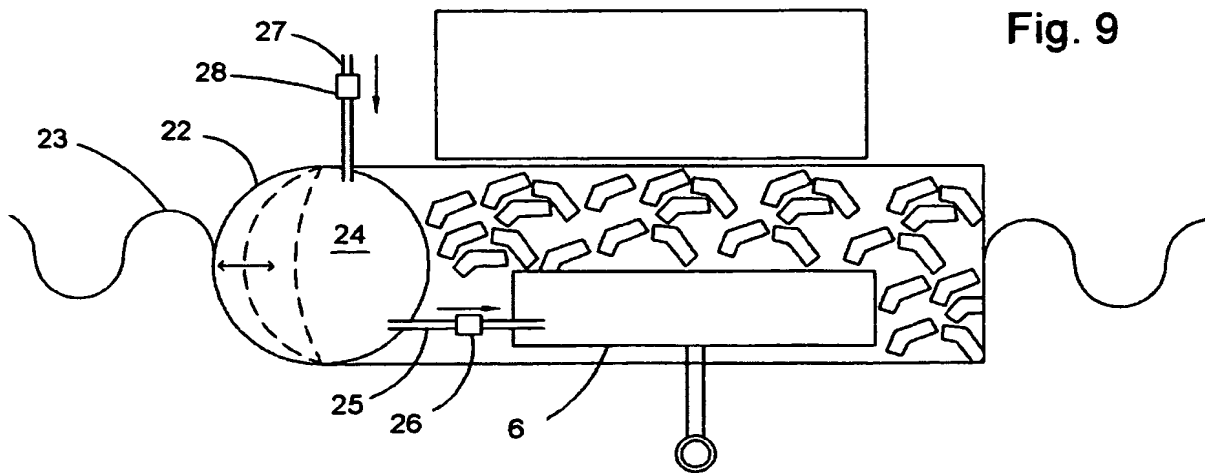


Fig. 10

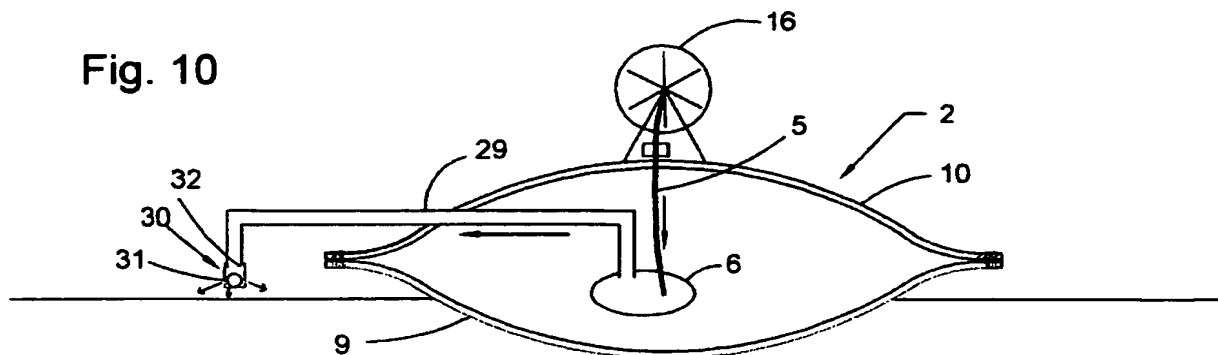


Fig. 11

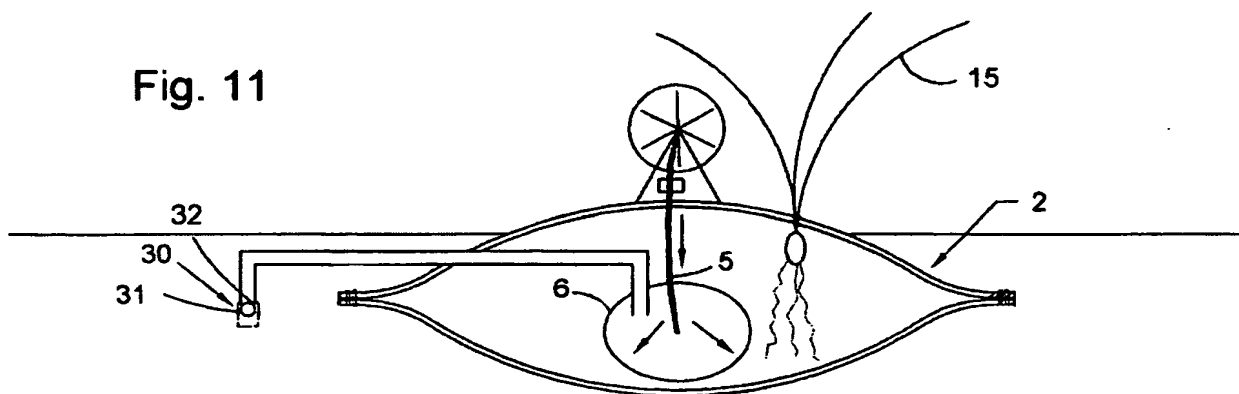
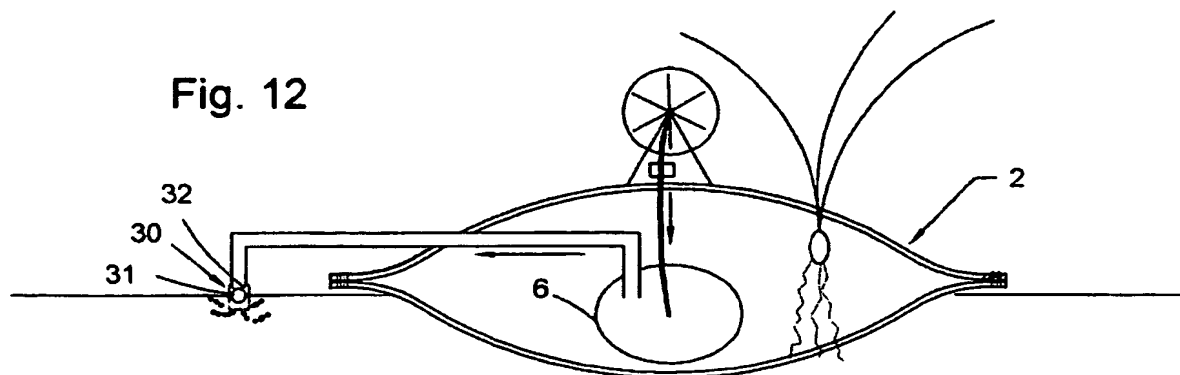
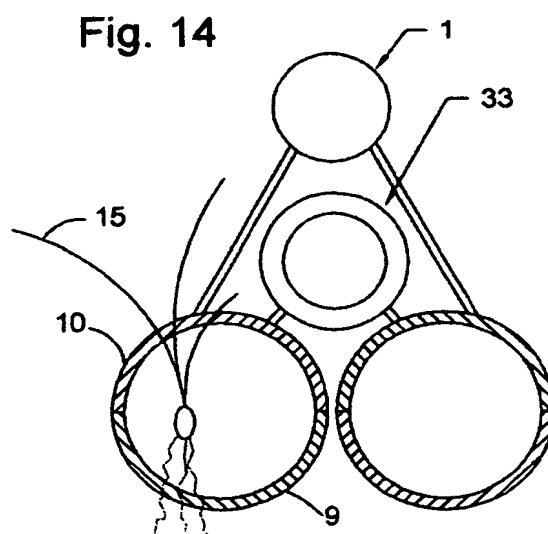
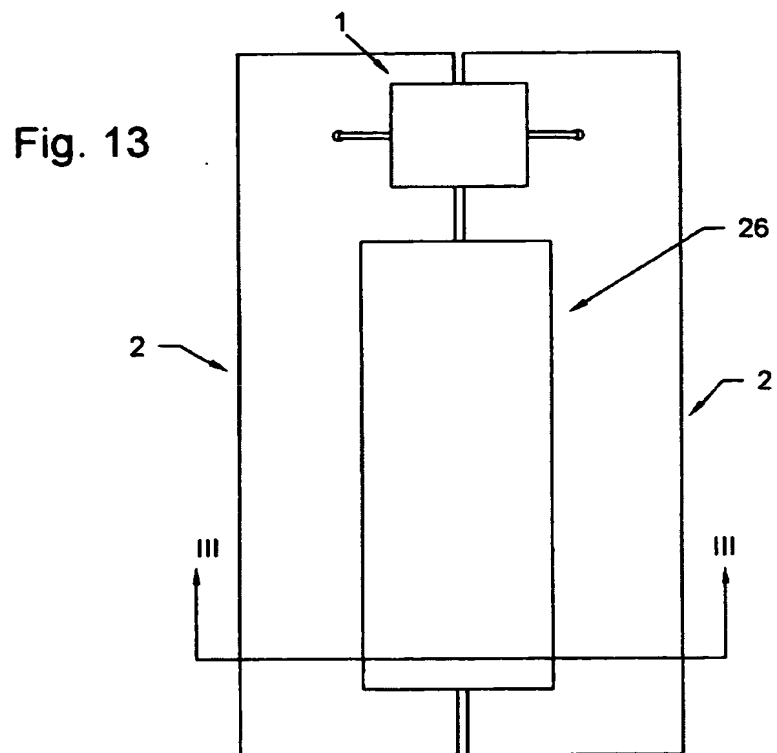


Fig. 12







**Application Data Sheet**

**Application Information**

Application Type::	Provisional
Subject Matter::	Utility
Suggested Classification::	Class 47
Suggested Group Art Unit::	
CD-ROM or CD-R?::	None
Title::	Renewably Buoyant, Self-Protective Floating Habitat
Request for Early Publication?::	No
Request for Non-Publication?::	No
Suggested Drawing Figure::	1
Total Drawing Sheets::	6
Small Entity?::	Yes
Petition included?::	No
Secrecy Order in Parent Appl.?::	No

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